

im Vertrieb von

CAMBOARD Electronics



KRAMER ELECTRONICS LTD.

# USER MANUAL

MODEL:

**VS-21 HDCP-IR**  
2x1 DVI Switcher

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P/N: 2900-000556 Rev 5

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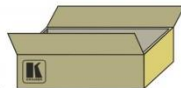


## VS-21HDCP-IR Quick Start Guide

This guide helps you install and use your product for the first time. For more detailed information, go to [http://www.kramerelectronics.com/support/product\\_downloads.asp](http://www.kramerelectronics.com/support/product_downloads.asp) to download the latest manual or scan the QR code on the left.

### Step 1: Check what's in the box

- ☒ **VS-21HDCP-IR** 2x1 DVI Switcher
- ☒ 1 Power supply (5V DC)
- ☒ 4 Rubber feet
- ☒ 1 Quick Start sheet
- ☒ Kramer **RC-IR3** Infrared Remote Control Transmitter with batteries and user manual



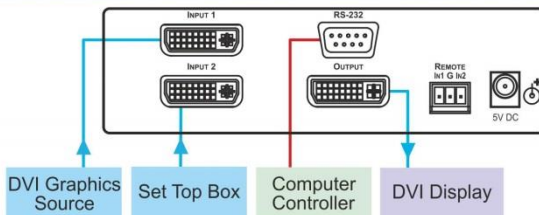
Save the original box and packaging materials in case you need to return your **VS-21HDCP-IR** for service.

### Step 2: Install the VS-21HDCP-IR

Attach the rubber feet and place on a table or mount the **VS-21HDCP-IR** in a rack (using an optional **RK-13** rack mount).

### Step 3: Connect the inputs and outputs

Always switch off the power on each device before connecting it to your **VS-21HDCP-IR**.



Always use Kramer high-performance cables for connecting AV equipment to the **VS-21HDCP-IR**.

### Step 4: Connect the power

Connect the 5V DC power adapter to the **VS-21HDCP-IR** and plug the adapter into the mains electricity.



### Step 5: Operate the VS-21HDCP-IR

Select an input via the:



IR remote control



Front panel buttons



Front panel buttons



Remote contact closure switch

Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Getting Started</b>	<b>2</b>
2.1	Achieving the Best Performance	2
2.2	Safety Instructions	3
2.3	Recycling Kramer Products	3
<b>3</b>	<b>Overview</b>	<b>4</b>
3.1	Defining the VS-21HDCP-IR 2x1 DVI Switcher	4
<b>4</b>	<b>Connecting the VS-21HDCP-IR</b>	<b>6</b>
4.1	Controlling the VS-21HDCP-IR via RS-232	7
4.2	Using the Remote Control Transmitter	8
4.3	Controlling via the Remote Terminal Block Connector	8
<b>5</b>	<b>Acquiring an EDID</b>	<b>9</b>
<b>6</b>	<b>Technical Specifications</b>	<b>10</b>
6.1	Default Communication Parameters	10
<b>7</b>	<b>Protocol 2000</b>	<b>11</b>
7.1	Syntax	11
7.2	Instruction Codes	12
<b>8</b>	<b>Protocol 3000 Syntax</b>	<b>13</b>
8.1	Host Message Format	13
8.2	Device Message Format	13
8.3	Command Terms	14
8.4	Entering Commands	15
8.5	Bidirectional Definition	15
8.6	Command Forms	15
8.7	Command Chaining	15
8.8	Maximum String Length	16
8.9	Backward Support	16
8.10	Commands	16

Figures

Figure 1: VS-21HDCP-IR 2x1 DVI Switcher	5
Figure 2: Connecting the VS-21HDCP-IR 2x1 DVI Switcher	7
Figure 3: Connecting the REMOTE Input Select Connector	8

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# 1 Introduction

Welcome to Kramer Electronics! Since 1981, Kramer Electronics has been providing a world of unique, creative, and affordable solutions to the vast range of problems that confront video, audio, presentation, and broadcasting professionals on a daily basis. In recent years, we have redesigned and upgraded most of our line, making the best even better!

Our 1,000-plus different models now appear in 11 groups that are clearly defined by function: GROUP 1: Distribution Amplifiers; GROUP 2: Switchers and Routers; GROUP 3: Control Systems; GROUP 4: Format/Standards Converters; GROUP 5: Range Extenders and Repeaters; GROUP 6: Specialty AV Products; GROUP 7: Scan Converters and Scalers; GROUP 8: Cables and Connectors; GROUP 9: Room Connectivity; GROUP 10: Accessories and Rack Adapters and GROUP 11: Sierra Products.

Congratulations on purchasing your Kramer **VS-21HDCP-IR** *2x1 DVI Switcher*, which is ideal for the following typical applications:

- Presentation graphics selection and routing

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## 2 Getting Started

We recommend that you:

- Unpack the equipment carefully and save the original box and packaging materials for possible future shipment
- Review the contents of this user manual



Go to <http://www.kramerelectronics.com> to check for up-to-date user manuals, application programs, and to check if firmware upgrades are available (where appropriate).

### 2.1 Achieving the Best Performance

To achieve the best performance:

- Use only good quality connection cables (we recommend Kramer high-performance, high-resolution cables) to avoid interference, deterioration in signal quality due to poor matching, and elevated noise levels (often associated with low quality cables)
- Do not secure the cables in tight bundles or roll the slack into tight coils
- Avoid interference from neighboring electrical appliances that may adversely influence signal quality
- Position your Kramer **VS-21HDCP-IR** away from moisture, excessive sunlight and dust



This equipment is to be used only inside a building. It may only be connected to other equipment that is installed inside a building.

## 2.2 Safety Instructions



**Caution:** There are no operator serviceable parts inside the unit

**Warning:** Use only the Kramer Electronics input power wall adapter that is provided with the unit

**Warning:** Disconnect the power and unplug the unit from the wall before installing

## 2.3 Recycling Kramer Products

The Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC aims to reduce the amount of WEEE sent for disposal to landfill or incineration by requiring it to be collected and recycled. To comply with the WEEE Directive, Kramer Electronics has made arrangements with the European Advanced Recycling Network (EARN) and will cover any costs of treatment, recycling and recovery of waste Kramer Electronics branded equipment on arrival at the EARN facility. For details of Kramer's recycling arrangements in your particular country go to our recycling pages at <http://www.kramerelectronics.com/support/recycling/>.

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## 3 Overview

The high quality Kramer **VS-21HDCP-IR** is an HDCP (High-Bandwidth Digital Content Protection) compatible *2x1 DVI Switcher* that accepts two DVI inputs—letting you select either DVI input using a pushbutton located on the front panel—and routes the selected DVI input signal to the DVI output.

DVI-D (Digital). Note that only the digital signal (DVI-D) is available on the DVI connector.

The **VS-21HDCP-IR** features:

- A maximum data rate of 6.75Gbps (2.25Gbps per graphic channel)
- HDCP compliance
- HDTV compatibility
- HDMI Support for Compressed Audio Channels
- EDID PassThru that passes EDID signals between the source and display
- Flexible control options that include front panel buttons, RS-232, IR remote control, remote contact closure
- Compact MultiTOOLS® size where three units can be rack mounted side-by-side in a 1U rack space with the optional RK-13 universal rack adapter

### 3.1 Defining the VS-21HDCP-IR 2x1 DVI Switcher

This section defines the **VS-21HDCP-IR**.

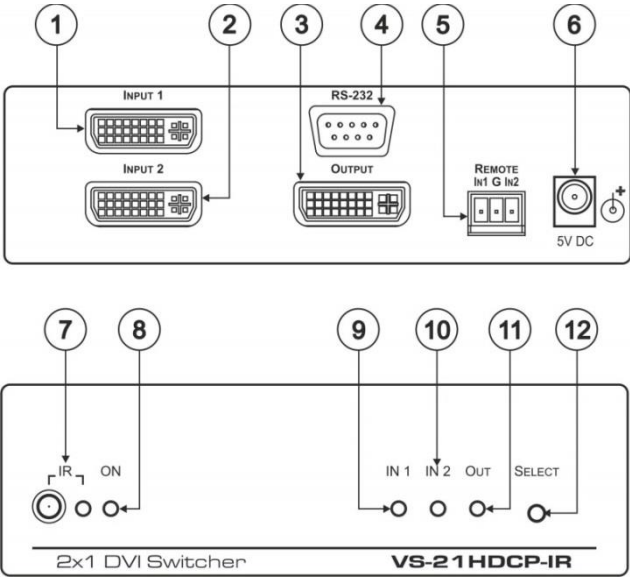


Figure 1: VS-21HDCP-IR 2x1 DVI Switcher

#	Feature	Function
1	INPUT 1 DVI Connector	Connect to the DVI source 1
2	INPUT 2 DVI Connector	Connect to the DVI source 2
3	OUTPUT DVI Connector	Connect to the DVI acceptor
4	RS-232 9-pin D-sub Connector	Connects to the PC or Serial Controller <i>No Null-modem adapter/Connector is required</i>
5	REMOTE Terminal Block Connectors	Connect to a contact closure switch (see Section 4.3)
6	5V DC	+5V DC connector for powering the unit
7	Remote IR Receiver Window and LED	Receives signals from the infrared remote control transmitter and the yellow LED lights when receiving signals from the infrared remote control transmitter
8	ON LED (Green)	Lights when receiving power
9	IN 1 LED (Green)	Lights when input 1 is selected
10	IN 2 LED (Green)	Lights when input 2 is selected
11	OUT LED (Green)	Lights when the output is connected
12	SELECT Switch	Press to toggle between selecting input 1 and input 2



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## 4 Connecting the VS-21HDCP-IR



Always switch off the power to each device before connecting it to your **VS-21HDCP-IR**. After connecting your **VS-21HDCP-IR**, connect its power and then switch on the power to each device.

To connect the **VS-21HDCP-IR** as illustrated in the example in [Figure 2](#):

1. Connect up to two DVI sources to the INPUT connectors, as follows:
  - INPUT 1 connector to DVI source 1 (for example, a computer)
  - INPUT 2 connector to DVI source 2 (for example, a set top box)
2. Connect the OUTPUT connector to the DVI acceptor (for example, a DVI display).
3. Connect the 5V DC power adapter to the power socket and connect the adapter to the mains electricity (not illustrated in [Figure 2](#)).
4. If required, connect a PC or controller to the RS-232 port (see [Section 4.1](#)).
5. Press the SELECT button to choose which DVI input to route to the output. The SELECT button toggles between INPUT 1 and INPUT 2, lighting the IN 1 LED when INPUT 1 is selected, or the IN 2 LED when IN 2 is selected. Alternatively you can press key 1 or 2 on the remote transmitter, once setup (see [Section 4.2](#)), or use the contact closure remote control pins (see [Section 4.3](#)) or use RS-232.

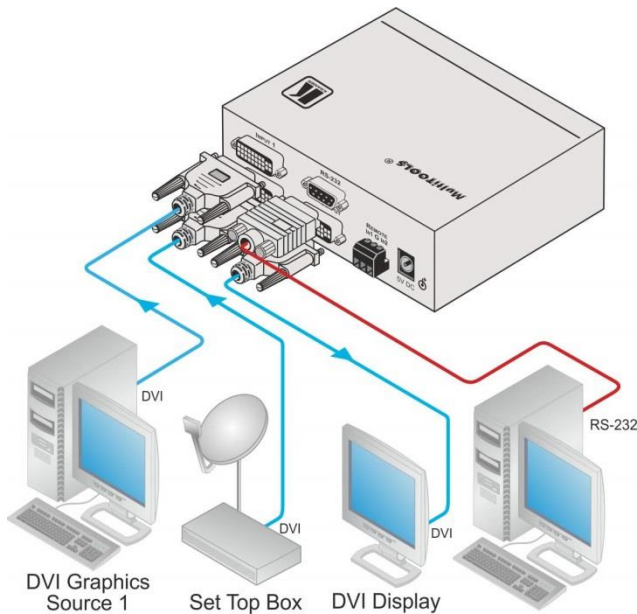


Figure 2: Connecting the VS-21HDCP-IR 2x1 DVI Switcher

## 4.1 Controlling via RS-232

You can connect to the **VS-21HDCP-IR** via an RS-232 connection using, for example, a PC. Note that a null-modem adapter/connection is not required.

To connect to the **VS-21HDCP-IR** via RS-232:

- Connect the RS-232 9-pin D-sub rear panel port on the **VS-21HDCP-IR** unit via a 9-wire straight cable (only pin 2 to pin 2, pin 3 to pin 3, and pin 5 to pin 5 need to be connected) to the RS-232 9-pin D-sub port on your PC

## 4.2 Controlling via the Remote Control Transmitter

You can use the remote control transmitter to switch INPUT 1 or 2 to the output. Before doing so, set it to work with the **VS-21HDCP-IR** by assigning a GROUP number.

The setup parameters for the remote control transmitter are as follows: router number = 1 (default); group number = 11, single digit mode (default), video (default). For further details, see the RC-IR3 user manual.

To assign the GROUP number on the remote control transmitter, do the following:

1. Point the remote control transmitter at the remote receiver and press the GROUP key.
2. Press key 11.

This sets and saves the group number.

To switch INPUT 1 or 2 to the output via the remote control transmitter, press key 1 or 2.

## 4.3 Controlling via the Remote Terminal Block Connector

The contact closure remote control pins operate in a similar way to the input SELECT button. Using the contact closure remote control lets you select an input by remote control. To do so, temporarily connect the required input (IN1 or IN2) pin on the REMOTE terminal block connector to the G (ground) pin, as illustrated in the examples in [Figure 3](#).



**Warning: DO NOT** connect more than one PIN to the G PIN at the same time.

To select IN1, attach PIN IN1 to the G PIN: To select IN2, attach PIN IN2 to the G PIN

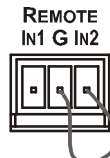
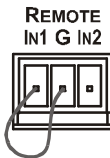


Figure 3: Connecting the REMOTE Input Select Connector

5

Acquiring an EDID

Initially, the **VS-21HDCP-IR** operates with the factory default EDID. This lets you connect the power before connecting one of the acceptors or the source. You can acquire the EDID from the output to one of the two inputs, or set the acquired EDID and the default EDID to both inputs.

To acquire the EDID, do the following:

1. Connect the power.
2. Connect the output.
3. Press and hold the SELECT button.

The IN LEDs illuminate in the following cycle: IN 1 flashes, IN 2 flashes, both illuminate and both blink (default).

4. Release the SELECT button when reaching the desired set up.

The EDID is now acquired:

IN LED Status	The EDID Acquired when Releasing the SELECT Button
IN 1 flashes	Output to input 1
IN 2 flashes	Output to input 2
IN 1 and IN 2 illuminate	Output to Input 1 and input 2 simultaneously
IN 1 IN 2 flash	Default value to Input 1 and input 2 simultaneously

6

Technical Specifications

INPUTS:	2 DVI-D on DVI-I connectors, 1.2Vpp; DDC signal 5Vpp (TTL)
OUTPUT:	1 DVI-D on a DVI-I connector; DDC signal 5Vpp (TTL)
BANDWIDTH:	6.75Gbps (2.25Gbps per graphic channel)
POWER CONSUMPTION:	5V DC, 250mA
OPERATING TEMPERATURE:	0° to +40°C (32° to 104°F)
STORAGE TEMPERATURE:	-40° to +70°C (-40° to 158°F)
HUMIDITY:	10% to 90%, RHL non-condensing
DIMENSIONS:	14.3cm x 12.2cm x 4.36cm (5.63" x 4.8" x 1.72", W, D, H)
WEIGHT:	0.3kg (0.67lbs) approx.
ACCESSORIES:	Power supply, infrared remote controller, bracket installation kit
Specifications are subject to change without notice at <a href="http://www.kramerelectronics.com">http://www.kramerelectronics.com</a>	

6.1

Default Communication Parameters

RS-232			
Protocol 2000		Protocol 3000 (Default)	
Baud Rate	9600	Baud Rate	115,200
Data Bits	8	Data Bits	8
Stop Bits	1	Stop Bits	1
Parity	None	Parity	None
Command Format	HEX	Command Format	ASCII
Example (Output 1 to Input 1)	0x01, 0x81, 0x81, 0x81	Example (Output 1 to Input 1)	#AV 1>1<CR>

6.2

Toggleing Between Protocols

To set the machine to Protocol 3000, do the following:

1. Disconnect the power.
2. Press and hold the SELECT button while connecting the power.  
The red IR LED flashes.
3. Release the SELECT button.

Use this method to switch between Protocol 3000 and Protocol 2000.

7

Protocol 2000

This RS-232/RS-485 communication protocol uses four bytes of information as defined below.

For RS-232, a null-modem connection between the machine and controller is used. The default data rate is 9600 baud, with no parity, 8 data bits and 1 stop bit.

**Note:** Compatibility with Kramer's Protocol 2000 does not mean that a machine uses all of the commands below. Each machine uses a sub-set of Protocol 2000, according to its needs.

7.1

Syntax

MSB								LSB
1st Byte	DESTINATION	INSTRUCTION						
0	D	N5	N4	N3	N2	N1	N0	
7	6	5	4	3	2	1	0	
2nd Byte	INPUT							
1	I6	I5	I4	I3	I2	I1	I0	
7	6	5	4	3	2	1	0	
3rd Byte	OUTPUT							
1	O6	O5	O4	O3	O2	O1	O0	
7	6	5	4	3	2	1	0	
4th Byte	MACHINE NUMBER							
1	OV	X	M4	M3	M2	M1	M0	
7	6	5	4	3	2	1	0	

- 1st Byte:

Bit 7 – Defined as 0  
D – DESTINATION:  
0 – Sends information to the switchers (from the PC)  
1 – Sends information to the PC (from the switcher)  
N5...N0 – INSTRUCTION
- The 6-bit INSTRUCTION defines the function performed by the switcher(s). If a function is performed using the machine's keyboard, these bits are set with the INSTRUCTION NO. performed. The instruction codes are defined according to the table below (INSTRUCTION NO. is the value set in N5...N0).
- 2nd Byte:

Bit 7 – Defined as 1  
I6...I0 – INPUT
- When switching (i.e. instruction codes 1 and 2), the 7-bit INPUT is set as the input number to be switched. If switching is done using the machine's front panel, these bits are set with the INPUT NUMBER switched. For other operations, these bits are defined according to the table.
- 3rd Byte:

Bit 7 – Defined as 1  
O6...O0 – OUTPUT
- When switching (i.e. instruction codes 1 and 2), the 7-bit OUTPUT is set as the output number to be switched. If switching is done using the machine's front panel, these bits are set with the OUTPUT NUMBER switched. For other operations, these bits are defined according to the table.
- 4th Byte:

Bit 7 – Defined as 1  
Bit 5 – Don't care  
OV – Machine number override  
M4...M0 – MACHINE NUMBER
- This byte is used to address machines in a system by their machine numbers. When several machines are controlled from a single serial port, they are usually configured together and each machine has an individual machine number. If the OV bit is set, then all machine numbers accept (implement) the command and the addressed machine replies. When a single machine is controlled over the serial port, always set M4...M0 to 1, and make sure that the machine itself is configured as MACHINE NUMBER = 1.

7.2

Instruction Codes

All the values in the table are decimal, unless otherwise stated

Instruction Codes for Protocol 2000				
Instruction		Definition for Specific Instruction		Notes
#	Description	Input	Output	
1	SWITCH VIDEO	Set equal to video input that is switched (0 = disconnect)	Set equal to video output that is switched (0 = to all the outputs)	2, 15

NOTES on the above table:

**NOTE 2** – These are bi-directional definitions. If the switcher receives the code, it performs the instruction. If the instruction is performed (due to a keystroke operation on the front panel), then these codes are sent. For example, if the PC sends HEX code:  
01            85            88            83  
then the switcher (machine 3) switches input 5 to output 8.  
If the user switches input 1 to output 7 using the front panel buttons, the switcher sends HEX code:  
41            81            87            83  
to the PC.  
When the PC sends one of the commands in this group to the switcher, if the instruction is valid, the switcher replies by sending the same four bytes to the PC that it received (except for the first byte, where the DESTINATION bit is set high).

**NOTE 15** – When the OVR bit (4<sup>th</sup> byte) is set, then the video commands have universal meaning. For example, instruction 1 (SWITCH VIDEO) causes all units (including audio, data, etc.) to switch. Similarly, if a machine is in FOLLOW mode, it performs any video instruction.

## 8 Protocol 3000 Syntax

With Kramer Protocol 3000 you can control the **VS-21HDCP-IR** from any standard terminal software (for example, the Windows<sup>®</sup> HyperTerminal Application).

This RS-232/RS-485 communications protocol uses a data rate of 115,200 baud, no parity, 8 data bits, and 1 stop bit.

### 8.1 Host Message Format

Start	Address (optional)	Body	Delimiter
#	Destination_id@	Message	<b>CR</b>

#### 8.1.1 Simple Command

Command string with only one command without addressing:

Start	Body	Delimiter
#	Command <b>SP</b> Parameter_1,Parameter_2,...	<b>CR</b>

#### 8.1.2 Command String

Formal syntax with commands concatenation and addressing:

Start	Address	Body	Delimiter
#	Destination_id@	Command_1 Parameter1_1,Parameter1_2,...  Command_2 Parameter2_1,Parameter2_2,...  Command_3 Parameter3_1,Parameter3_2,... ...	<b>CR</b>

### 8.2 Device Message Format

Start	Address (optional)	Body	delimiter
~	Sender_id@	Message	<b>CR LF</b>

#### 8.2.1 Device Long Response

Echoing command:

Start	Address (optional)	Body	Delimiter
~	Sender_id@	Command <b>SP</b> [Param1 ,Param2 ...] <b>result</b>	<b>CR LF</b>

**CR** = Carriage return (ASCII 13 = 0x0D)

**LF** = Line feed (ASCII 10 = 0x0A)

**SP** = Space (ASCII 32 = 0x20)



## 8.3 Command Terms

### Command

A sequence of ASCII letters ('A'-'Z', 'a'-'z' and '-').

Command and parameters must be separated by at least one space.

### Parameters

A sequence of alphanumeric ASCII characters ('0'-'9', 'A'-'Z', 'a'-'z' and some special characters for specific commands). Parameters are separated by commas.

### Message string

Every command entered as part of a message string begins with a message starting character and ends with a message closing character.

**Note:** A string can contain more than one command. Commands are separated by a pipe ( '|') character.

### Message starting character

'#' – For host command/query

'~' – For machine response or machine command performed by keystroke operation on the front panel or IR remote controller.

**Device address** (Optional when directly connected to the device)

K-Net Device ID or MACHINE NUMBER followed by '@'

(ex. #02@CRLF)

### Query sign

'?' follows some commands to define a query request.

### All outputs sign

'\*' defines all outputs.

### Message closing character

CR – For host messages; carriage return (ASCII 13)

CRLF – For machine messages; carriage return (ASCII 13) + line-feed (ASCII 10)

**Command chain separator character**

When a message string contains more than one command, a pipe ( '|' ) character separates each command.

Spaces between parameters or command terms are ignored.

## 8.4 Entering Commands

You can directly enter all commands using a terminal with ASCII communication software, such as HyperTerminal, Hercules, etc. Connect the terminal to the serial, Ethernet, or USB port on the Kramer device. To enter `CR`, press the Enter key. ( `LF` is also sent but is ignored by the command parser).

For commands sent from some non-Kramer controllers like Crestron, some characters require special coding (such as, `/X##`). Refer to the controller manual.

## 8.5 Bidirectional Definition

All commands are bidirectional. That is, if the device receives the code, it will perform the instruction; and if the instruction is performed (due to a keystroke operation on the front panel or IR controller), then these codes are sent to the PC or other RS-232 / Ethernet / USB controller.

## 8.6 Command Forms

Some commands have short name syntax in addition to long name syntax to allow faster typing. The response is always in long syntax.

## 8.7 Command Chaining

Multiple commands can be chained in the same string. Each command is delimited by a pipe character ( '|' ). When chaining commands, enter the message starting character and the message closing character only once, at the beginning of the string and at the end.

Commands in the string do not execute until the closing character is entered.

A separate response is sent for every command in the chain.

8.8 Maximum String Length

64 characters

8.9 Backward Support

Protocol 2000 is transparently supported by Protocol 3000. You can switch between protocols using a switch protocol command from either platform.

8.10 Commands

8.10.1 Help Commands

Command	Syntax	Response
Protocol handshaking	# <b>CR</b>	~OK <b>CR</b> <b>LF</b>

8.10.2 Common Commands

Command	Description	Syntax	Response
MODEL?	Read device model	MODEL?	MODEL MACHINE_MODEL
VERSION?	Read device firmware version	VERSION?	VERSION MAJOR.MINOR.BUILD.REVISION

8.10.3 Basic Routing Commands

Command	Cmd Short	Description	Syntax	Response
AV		Switch audio and video	AV <b>IN&gt;OUT</b> , <b>IN&gt;OUT</b> , ...	AV <b>IN&gt;OUT</b> , <b>IN&gt;OUT</b> ,... <b>RESULT</b>
AV?		Query audio and video	AV <b>IN&gt;OUT</b> , <b>IN&gt;OUT</b> , ...	AV <b>IN&gt;OUT</b> , <b>IN&gt;OUT</b> ,... <b>RESULT</b>
VID	V	Switch video only	VID <b>IN&gt;OUT</b> , <b>IN&gt;OUT</b> , ... Short form: V <b>IN&gt;OUT</b> , <b>IN&gt;OUT</b> , ...	VID <b>IN&gt;OUT</b> , <b>IN&gt;OUT</b> ,... <b>RESULT</b>
VID?	V?	Query Switch video only	VID? <b>OUT</b> Short form: V? <b>OUT</b> VID? *	VID <b>IN&gt;OUT</b>  VID <b>IN&gt;1</b> , <b>IN&gt;2</b> , ...

8.10.4 Result and Error Codes

Result	Syntax
Command ran successfully, no error.	<b>COMMAND</b> <b>PARAMETERS</b> OK

Protocol Errors:

Syntax error	ERR001
Command not available for this device	ERR002
Parameter is out of range	ERR003
Unauthorized access (command run without the matching login).	ERR004

**LIMITED WARRANTY**

The warranty obligations of Kramer Electronics for this product are limited to the terms set forth below:

**What is Covered**

This limited warranty covers defects in materials and workmanship in this product.

**What is Not Covered**

This limited warranty does not cover any damage, deterioration or malfunction resulting from any alteration, modification, improper or unreasonable use or maintenance, misuse, abuse, accident, neglect, exposure to excess moisture, fire, improper packing and shipping (such claims must be presented to the carrier), lightning, power surges, or other acts of nature. This limited warranty does not cover any damage, deterioration or malfunction resulting from the installation or removal of this product from any installation, any unauthorized tampering with this product, any repairs attempted by anyone unauthorized by Kramer Electronics to make such repairs, or any other cause which does not relate directly to a defect in materials and/or workmanship of this product. This limited warranty does not cover cartons, equipment enclosures, cables or accessories used in conjunction with this product.

Without limiting any other exclusion herein, Kramer Electronics does not warrant that the product covered hereby, including, without limitation, the technology and/or integrated circuit(s) included in the product, will not become obsolete or that such items are or will remain compatible with any other product or technology with which the product may be used.

**How Long Does this Coverage Last**

Seven years as of this printing; please check our Web site for the most current and accurate warranty information.

**Who is Covered**

Only the original purchaser of this product is covered under this limited warranty. This limited warranty is not transferable to subsequent purchasers or owners of this product.

**What Kramer Electronics will do**

Kramer Electronics will, at its sole option, provide one of the following three remedies to whatever extent it shall deem necessary to satisfy a proper claim under this limited warranty:

1. Elect to repair or facilitate the repair of any defective parts within a reasonable period of time, free of any charge for the necessary parts and labor to complete the repair and restore this product to its proper operating condition. Kramer Electronics will also pay the shipping costs necessary to return this product once the repair is complete.
2. Replace this product with a direct replacement or with a similar product deemed by Kramer Electronics to perform substantially the same function as the original product.
3. Issue a refund of the original purchase price less depreciation to be determined based on the age of the product at the time remedy is sought under this limited warranty.

**What Kramer Electronics will not do Under This Limited Warranty**

If this product is returned to Kramer Electronics or the authorized dealer from which it was purchased or any other party authorized to repair Kramer Electronics products, this product must be insured during shipment, with the insurance and shipping charges prepaid by you. If this product is returned uninsured, you assume all risks of loss or damage during shipment. Kramer Electronics will not be responsible for any costs related to the removal or re-installation of this product from or into any installation. Kramer Electronics will not be responsible for any costs related to any setting up this product, any adjustment of user controls or any programming required for a specific installation of this product.

**How to Obtain a Remedy under this Limited Warranty**

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**SAFETY WARNING**

Disconnect the unit from the power supply before opening and servicing



P/N: 2900-000556



Rev: 5

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